Quarterly Report – Public Page

Date of Report: *8th Quarterly Report-September 28, 2020*
Contract Number: *693JK31810011*
Prepared for: *Government Agency: USDOT - PHMSA*
Project Title: *River Scour Monitoring System for Pipeline Threat Prevention*
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For quarterly period ending: *September 30, 2020*

1: Items Completed During this Quarterly Period:

During the 8th Quarter, the following items were completed:

Item #	***Task #***	***Activity/Deliverable***	***Title***	***Federal Cost***	***Cost Share***
24	***2***	System Upgrade (version 4.0)	Upgrading of system	$18,000.00	$18,000.00
25	***5***	Software/Website Upgrade (version 3.0)	Upgrading software/website	$15,000.00	$15,000.00
28	***7***	Daily data collection	Collection of field data	$ 3,000.00	$ 7,500.00
29	***7***	Monthly analysis of data	Summary report of monthly data	$ 10,000.00	$10,000.00
37	***8***	8th Quarterly Status Report	Quarterly report	$ 2,175.00	$ 1,000.00

2: Items Not-Completed During this Quarterly Period:

The following tasks were not completed during this Quarterly Period:

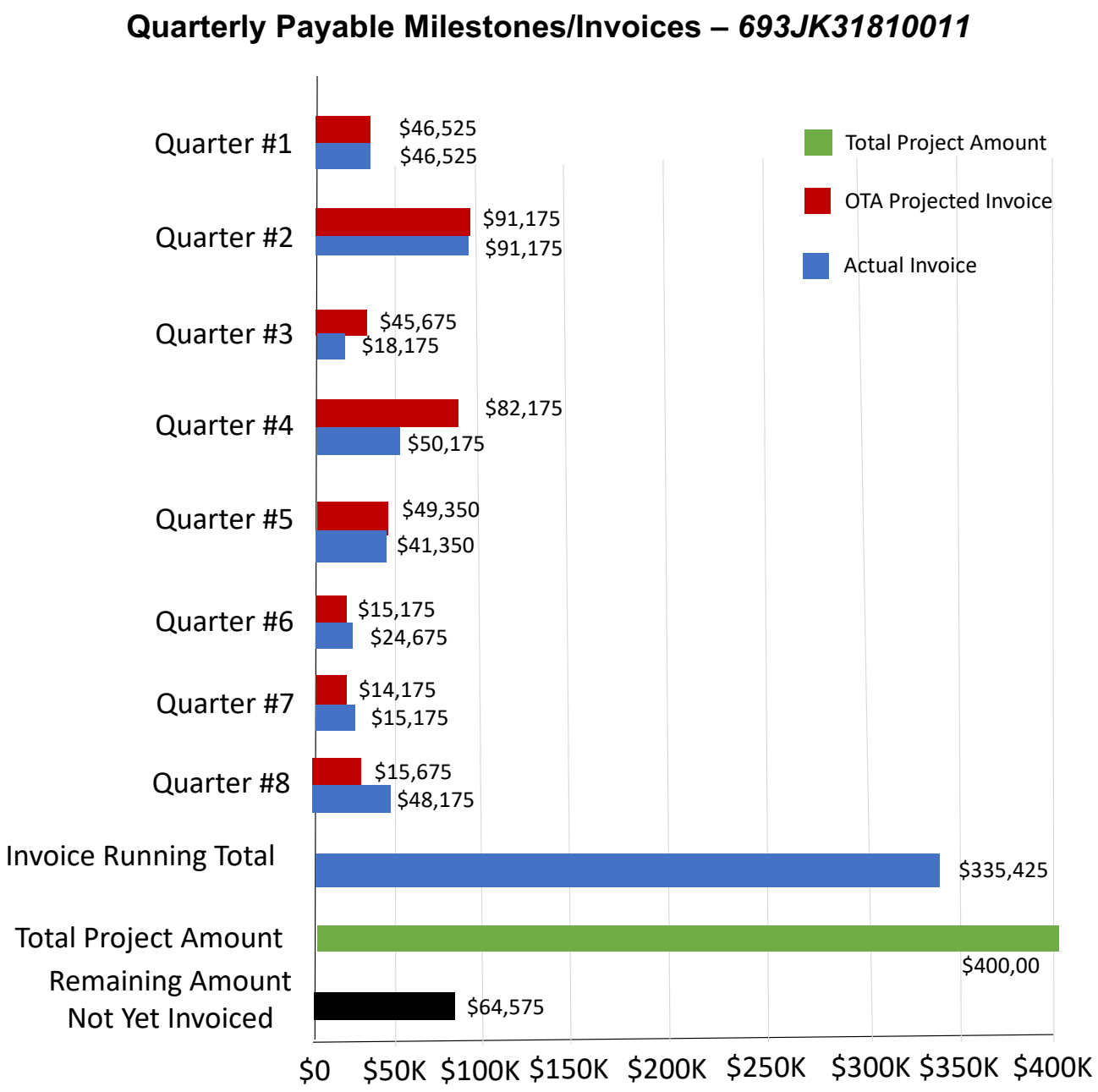
Item #	***Task #***	***Activity/Deliverable***	***Title***	***Federal Cost***	***Cost Share***
31	***7***	Daily data collection	Collection of field data	$ 3,000.00	$ 7,500.00
32	***7***	Monthly analysis of data	Summary report of monthly data	$ 9,000.00	$ 9,000.00
34	***7***	Daily data collection	Collection of field data	$ 3,000.00	$ 7,500.00
35	***7***	Monthly analysis of data	Summary report of monthly data	$ 3,000.00	$ 3,000.00
36	***7***	Prepare report for each installation	Summary report for each site installation	$ 7,500.00	$ 7,500.00

Item 31/34, Task 7 – Daily data collection, we are currently collecting data from five recent installations of the River Scour Monitoring Systems that were deployed in late November, December, and March.

Item 32/35, Task 7 – Monthly analysis of data, we will continue to analyze the collected data from the installations.

Item 36, Task 7 – Summary report for each site installation, we are preparing these reports; however, we need to collect additional information due to the delay in obtaining permits for the installations.

3: Project Financial Tracking During this Quarterly Period:



4: Project Technical Status

System Upgrade (version 4.0)

Item #24, Task #2 – System Upgrade (version 4.0), we integrating a camera into the system to give a visual indication of the river status using an off the shelf product on the Freeman River site. An automated bias calibration with SCADA information was also implemented to provide better analysis.

Software/Website Upgrade (version 3.0)

Item #25, Task #5 – Software upgrade (version 3.0) to create an adaptive algorithm to optimize the pipe sensor bias correction. Previously the software used 4 bias correction parameters to account for environmental or calibration errors. Since the ground temperature was found to be generally quite stable and consistent across sections, we eliminated the reliance on ground sensors to remove 2 biases. Now using overall heat transfer ratios to set a "scour threshold" that can be set to alarm when the system crosses it. Figure 1 illustrates the new software output.

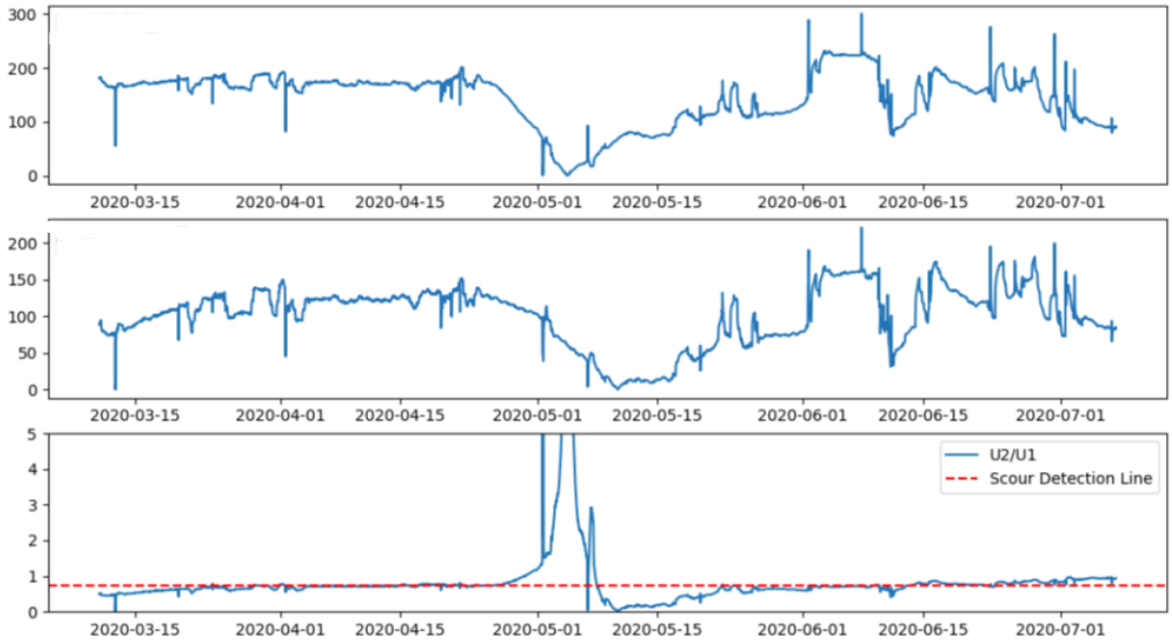


Figure 1. New Software Output

Data Collection and Monthly Data Analysis

Item #28/29, Task #7 – Daily data collection (every 10 minutes) and monthly analysis was conducted for the five installations at the Tongue River (2), Elk River (2), and Freeman River (1) sites installed in November, December and March, respectively. Temperature data on the pipe, soil and air as well as a battery voltage is being collected every ten minutes at each sensor location since installation. Currently the data is viewed on the Pure hub with an interactive graph and downloaded as an excel spreadsheet.

Tongue River, North Dakota

The Tongue River system was installed between November 18th and 20th, 2019. Two pipelines are currently being monitored for temperature changes. Sample data on Pipeline #1 is presented in Figure 2, while data for Pipeline #2 is shown in Figure 3.

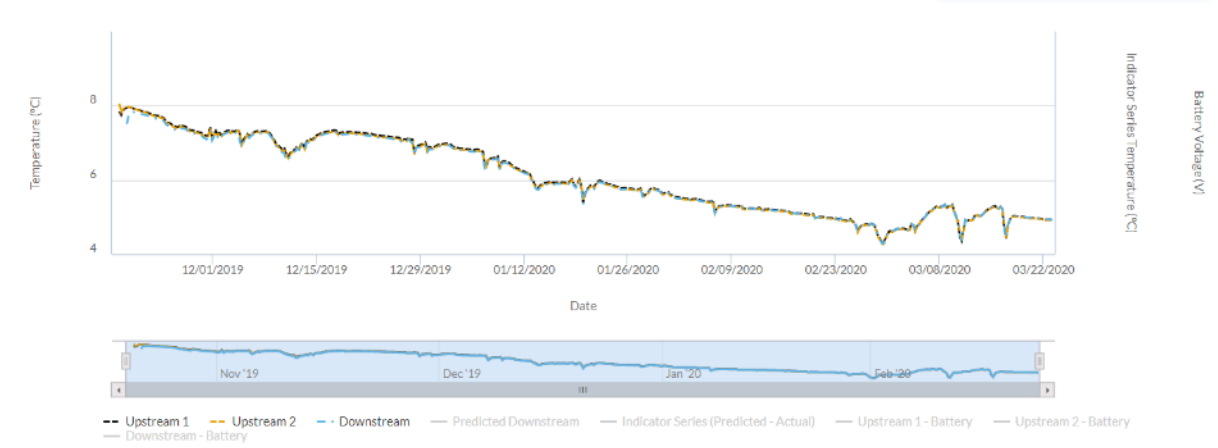


Figure 2. Pipeline Temperatures on Tongue River Pipeline #1

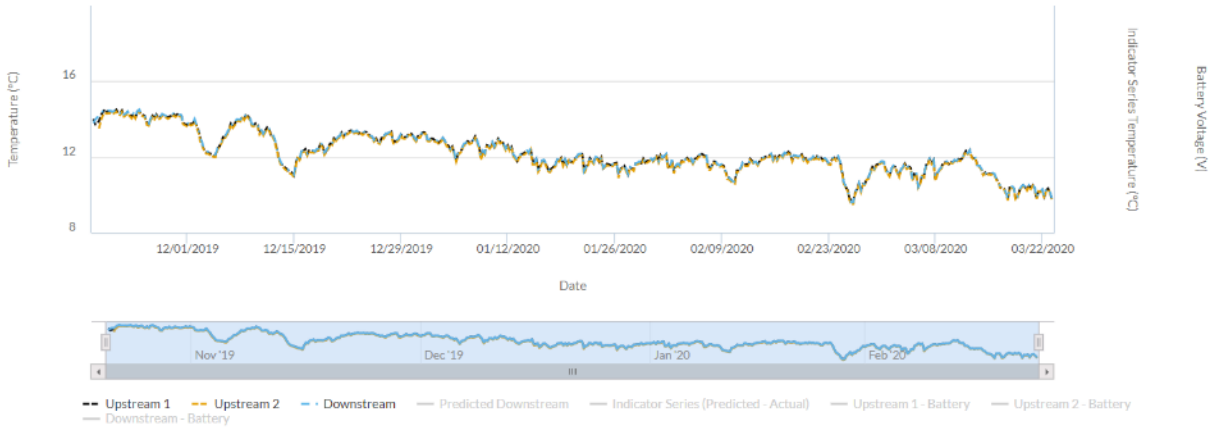


Figure 3. Pipeline Temperatures on Tongue River Pipeline #2

Elk River, Kansas

The Elk River system was installed between December 3rd and 7th, 2019 in Kansas. Two pipelines are currently being monitored for temperature changes. Pipeline #1 was installed in the 1950s using open cut construction to cross the river. Pipeline #2 was installed in the 2000s and used a horizontal directional drill to construct the river crossing. Sample graphs for Pipeline #1 and #2 are presented in Figure 4, Figure 5, respectively.

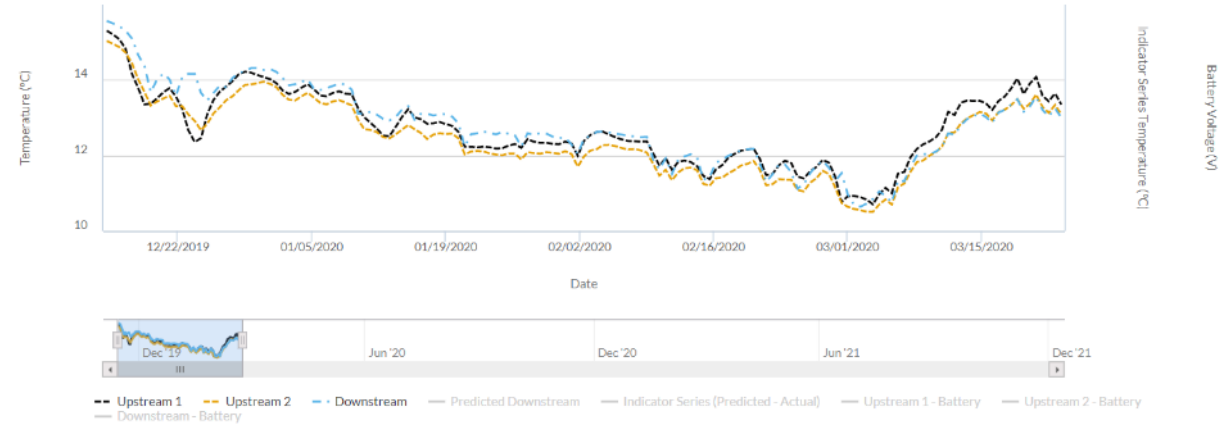


Figure 4. Pipeline Temperatures on Elk River Pipeline #1

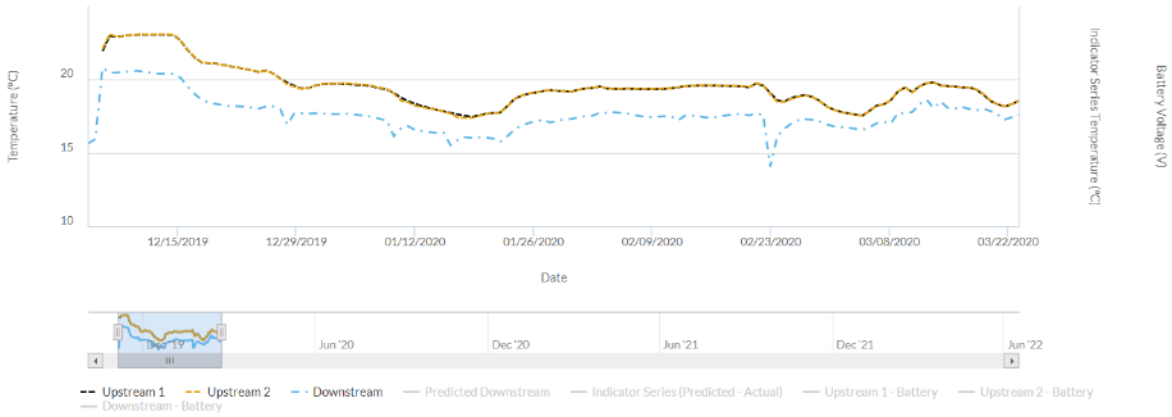


Figure 5. Pipeline Temperatures on Elk River Pipeline #2

Freeman River, Alberta Canada

The Freeman River system was installed March 7-11, 2020 on a 16-inch pipeline owned and operated by Pembina Pipelines under the Freeman River near Fort Assiniboine, Alberta Canada. Three sensors were placed on the pipeline; two upstream and one downstream. The pipeline was exposed and recoated using conventional trenchless pipeline repair methods. The pipeline is currently being monitored for temperature changes. Sample graphs for the pipeline are presented in Figure 6. A camera system was installed in April 2020 to take daily pictures to monitor the river condition throughout the winter melt and subsequent flooding. A picture captured of the crossing from the camera system is shown in Figure 7. In June 2020, after some high river levels, a potential scour was identified during analysis of the data. A crew was mobilized on a survey boat with a high-resolution multi-beam sonar device to map the bottom of the river to verify a pipe exposure as shown in Figure 8. After analysis, it was determined that the pipe area exposed to water was only 0.79 m^2. This will continue to be monitored over time.

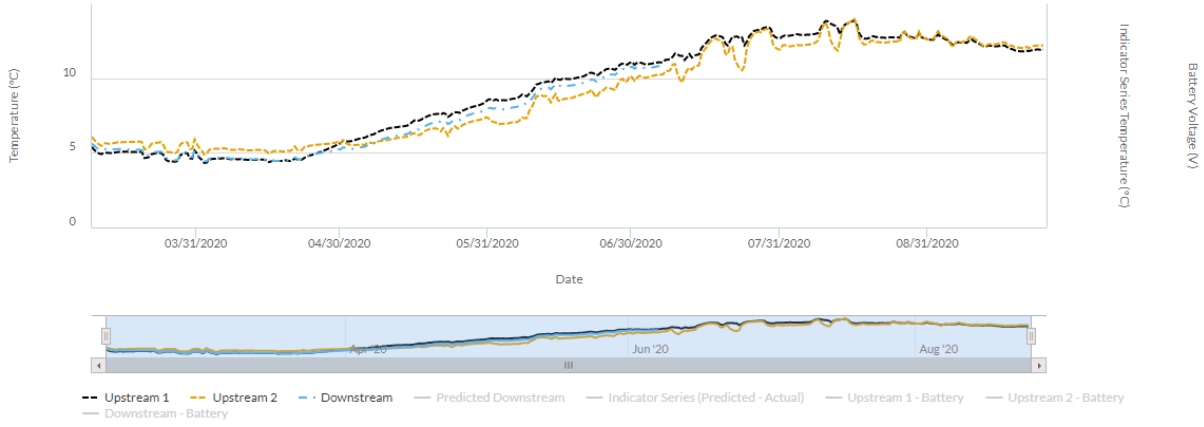


Figure 6. Pipeline Temperatures on Freeman River Pipeline

Figure 7. Freeman River Pipeline Crossing on May 2, 2020

Figure 8. Survey Boat containing High-Resolution Multi-Beam Sonar

5: Project Schedule

As discussed in Quarterly Report #6 and #7, the project is slightly behind schedule due to permitting issues. These have been resolved and now all five installations of the River Scour Monitoring Systems (RSS) have been complete in North Dakota, Kansas, and Alberta. We continue to successfully collect and analyze the data using remote communication.

We encountered an unforeseeable situation. During an inspection of the Freeman River site, the Pembina Pipelines Right-of-Way Manager discovered some transient people camped out by the river. Upon examining the RSS, it was discovered that the unit was completely destroyed and components stolen. The Royal Canadian Mounted Police (RCMP) were quickly dispatched and arrested the perpetrators and recovered some of the stolen items that were in their possession. However, the unit was destroyed beyond repair. Fortunately, we still have four other installations collecting data without any issues. This should provide us plenty of data to validate the project results.